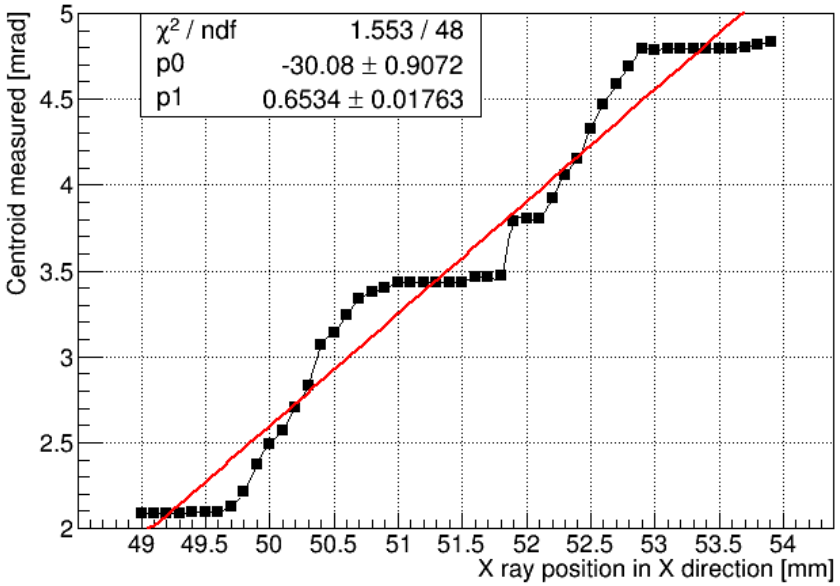
Topics:

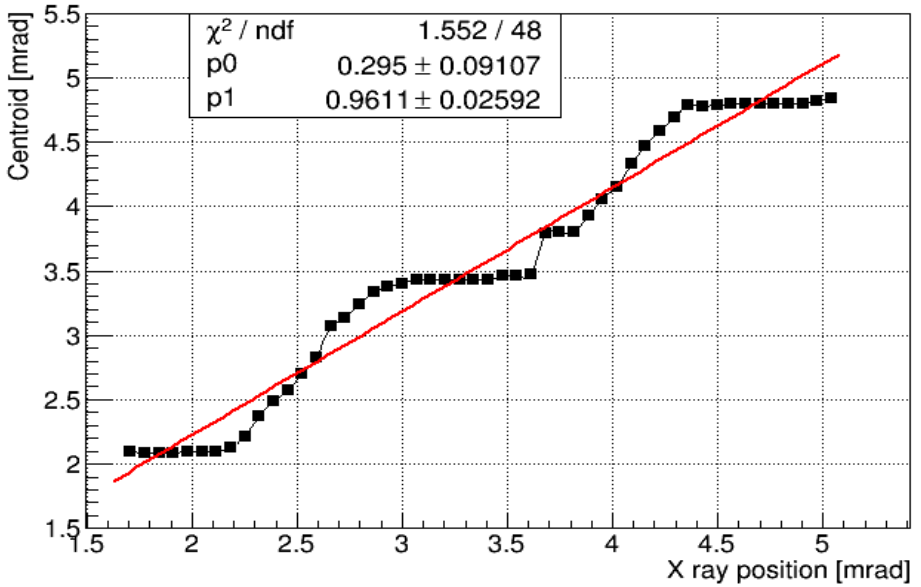
- Resolution studies with the zz board scan data
- Some work on the zigzag design to compensate the “over etching” issue during board fabrication.

Aiwu Zhang

03/14/2016

EIC Tracking R&D Monday meeting



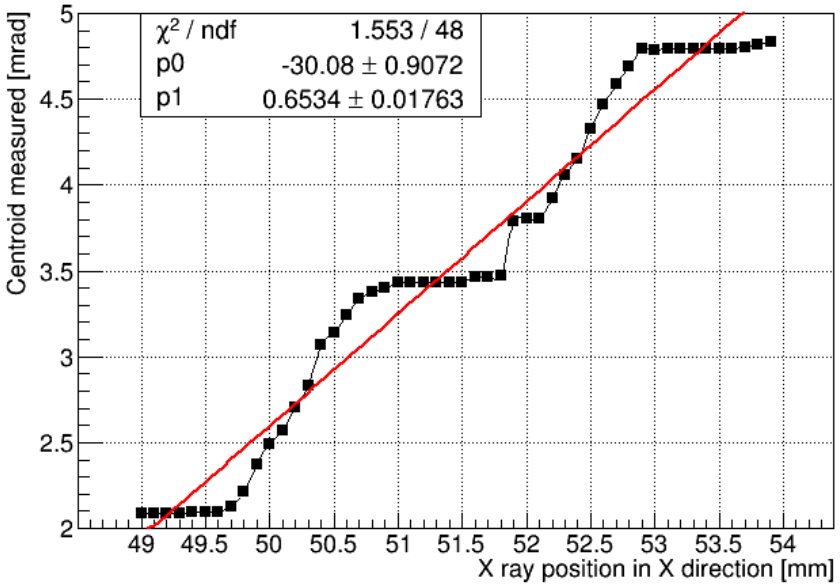


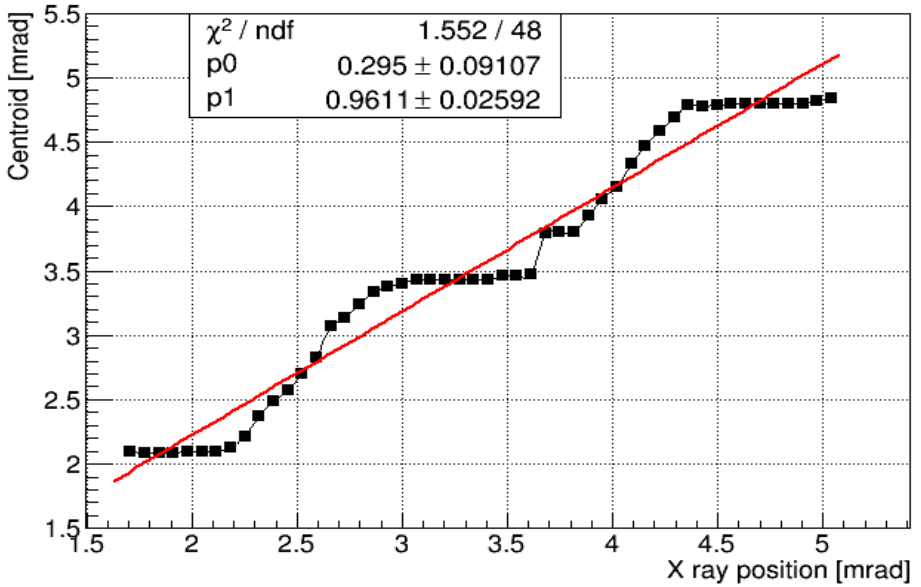
Transform x ray position (X axis) to board coordinate (so unit is mrad now)

Method discussion:

- The centroid (in mrad) and X ray position (in mm) are from two different Cartesian coordinate systems, the two coordinate systems are linear transformable. (Due to precision on the measurement of X ray position, it is difficult to make a plot with both X and Y axes in the same range and to see whether the curve is diagonal in that plot. The results about residual should be the same in two systems!)

- Fit the curve above, it gives a function (correlation) of centroid versus x ray position. Given an X ray position, based on the fit line, the expected centroid can be calculated; then deviation (residual) can be made out by “Centroid_expect - Centroid_measured”.





Transform x ray position (X axis) to board coordinate (so unit is mrad now)

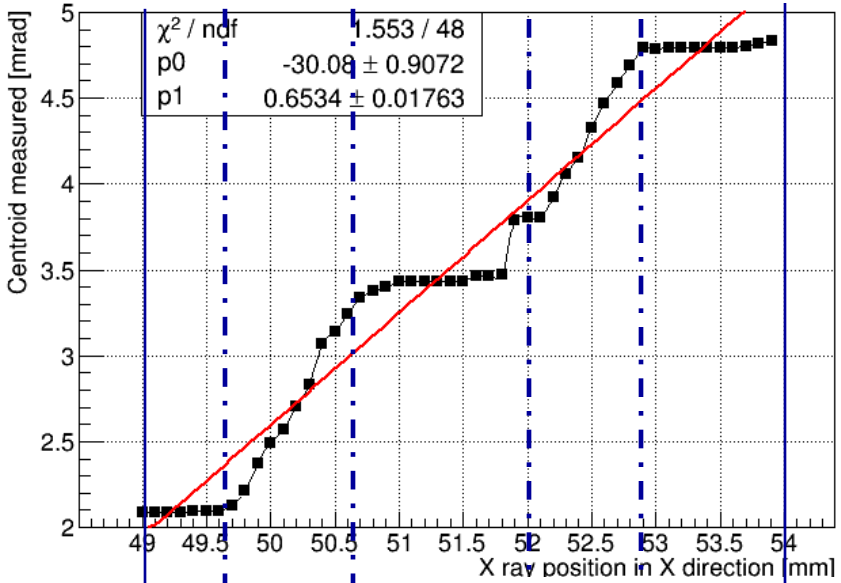
Method discussion:

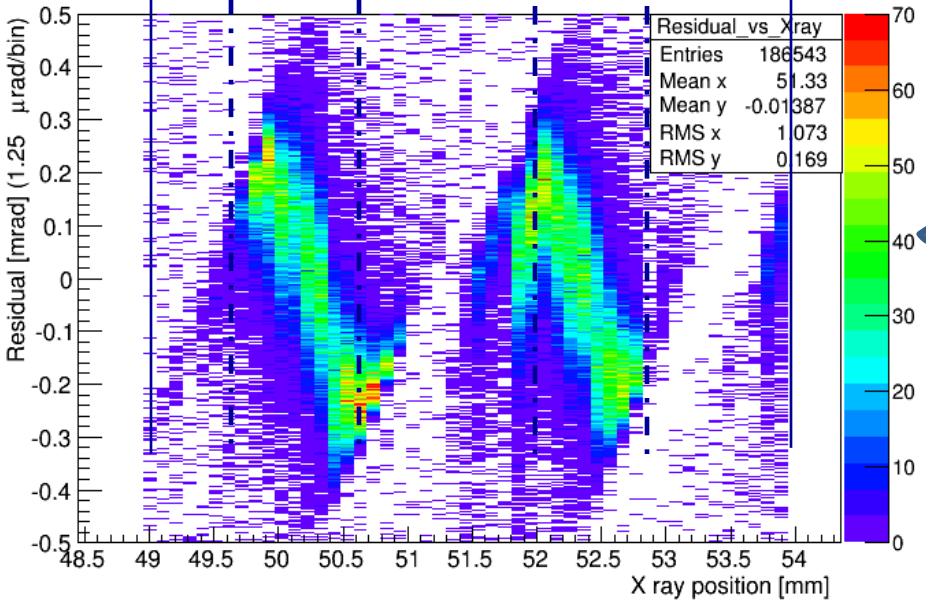
- We notice that the slope of the fit line on the right plot is close to 1, the measured centroid versus X ray position curve should follow that diagonal line if the readout has linear response.

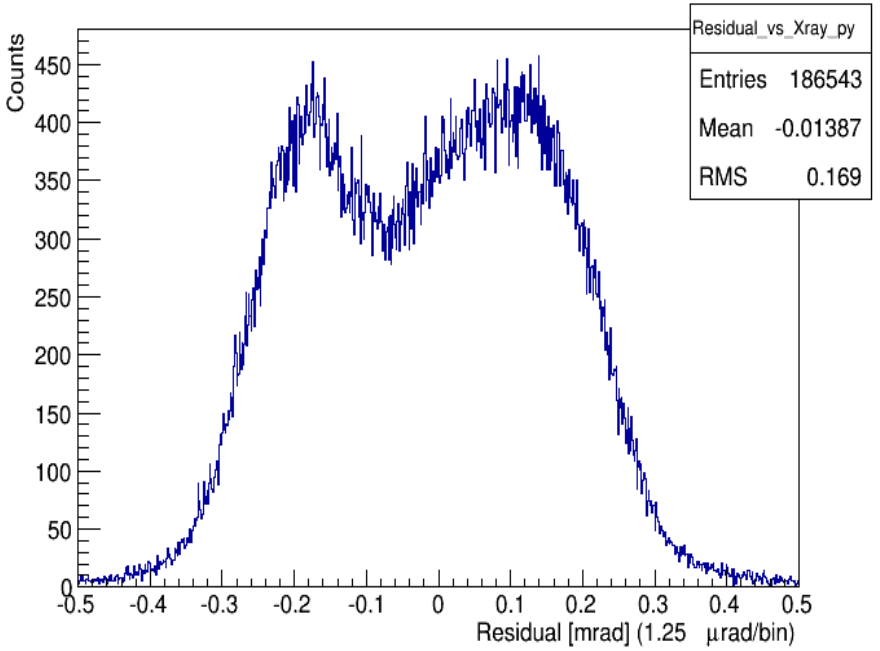
- Now, the linear regions on the measured curve are not following the diagonal line, this indicates even in the linear regions there exists non-linear response.

Results – scan on ZZ_48 board, along phi (across strips)

Mean Centroid (in phi) vs. X (Y=53.2 mm)



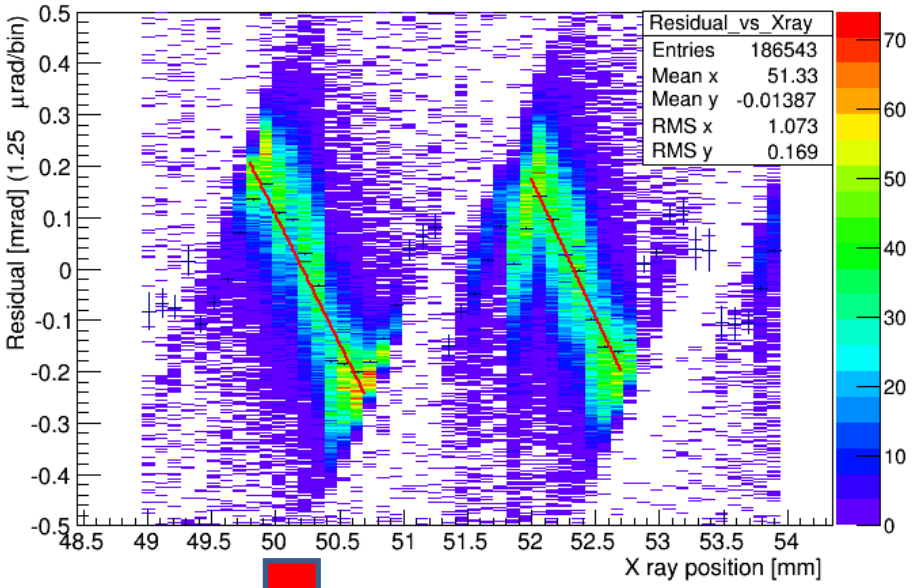


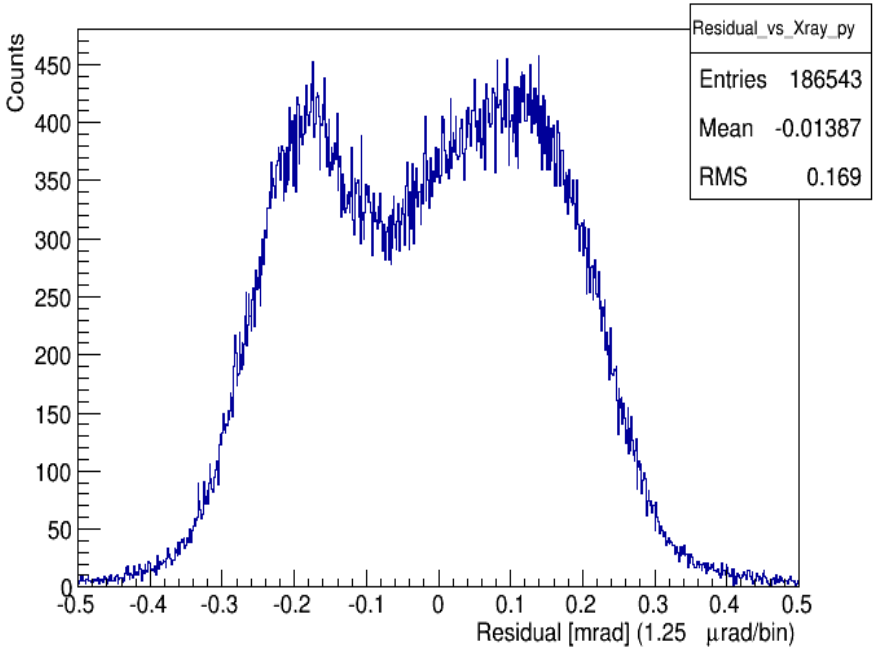


Projection in Y axis

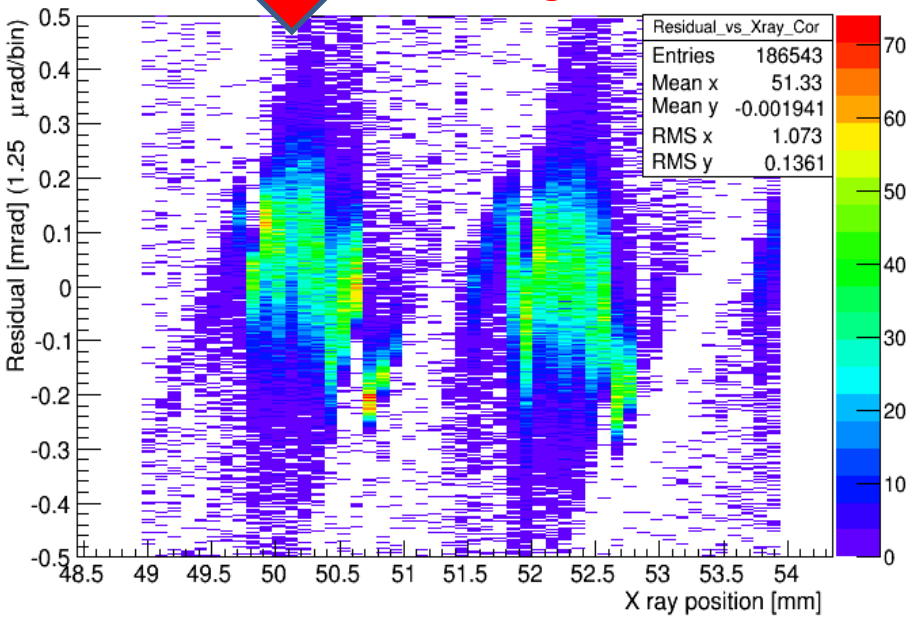
Results – scan on ZZ_48 board, along phi (across strips)

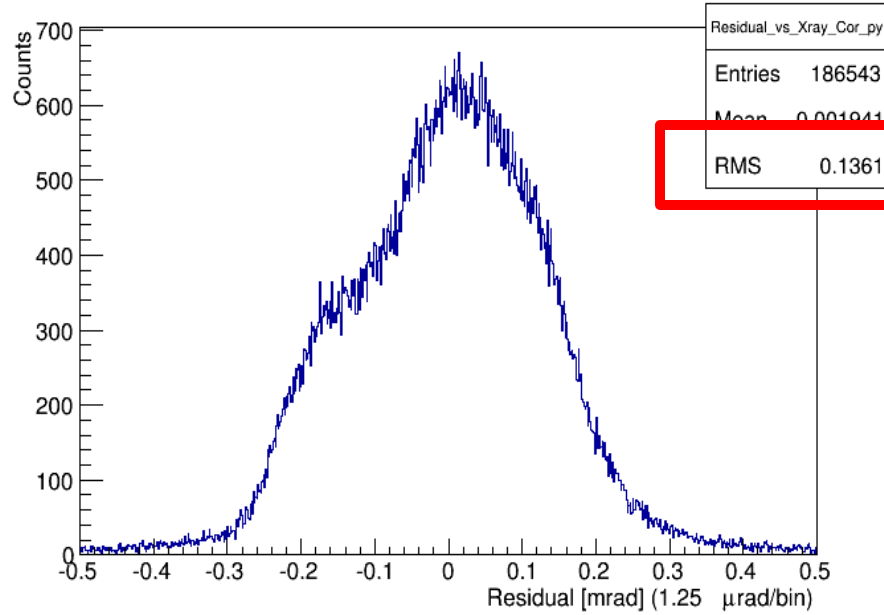
Mean Centroid (in phi) vs. X (Y=53.2 mm)



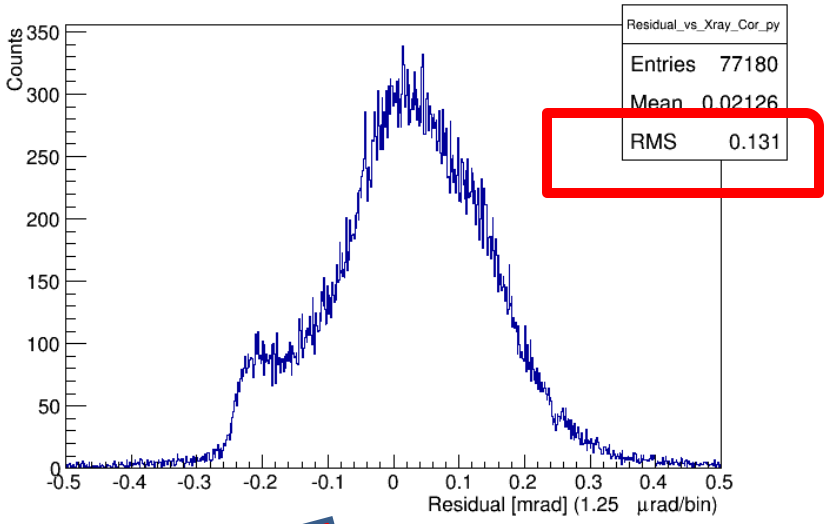


Linear region corrected



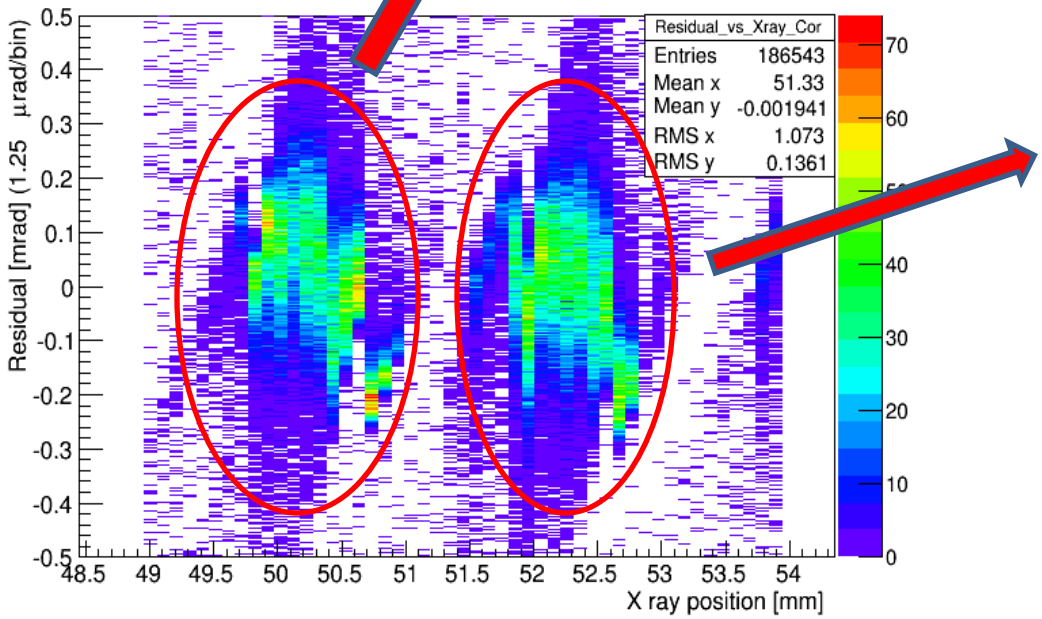


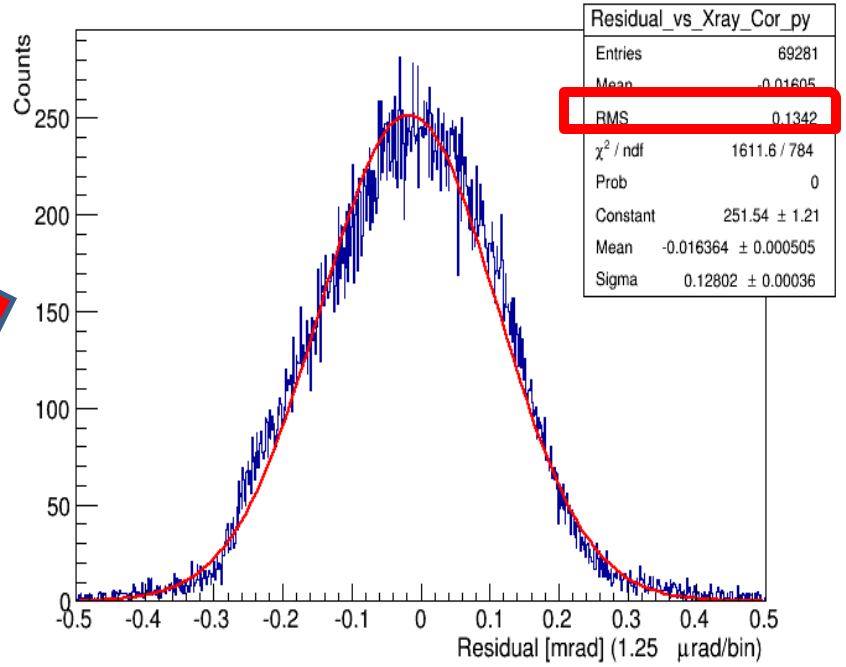
Results – scan on ZZ_48 board, along phi (across strips)



Rms: ~130 urad.

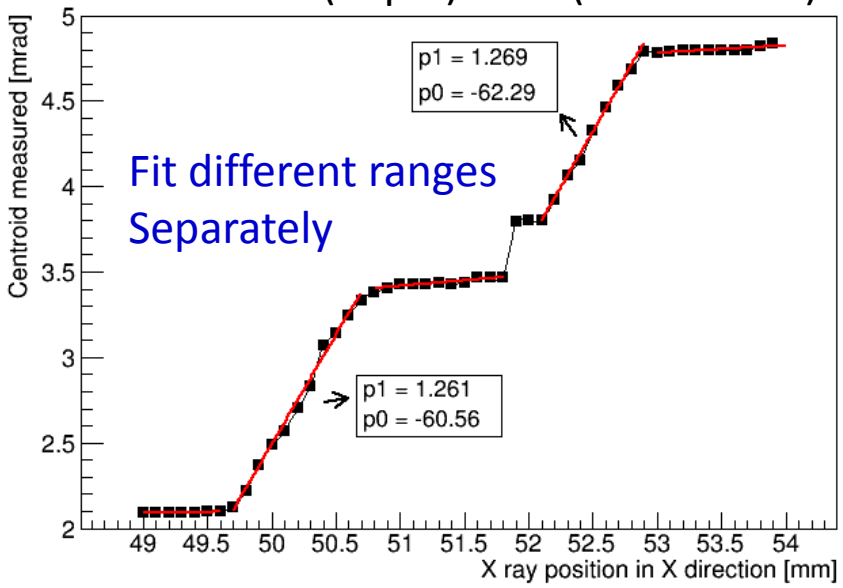
If consider the 50 um width of the collimator, resolution is ~125 urad.

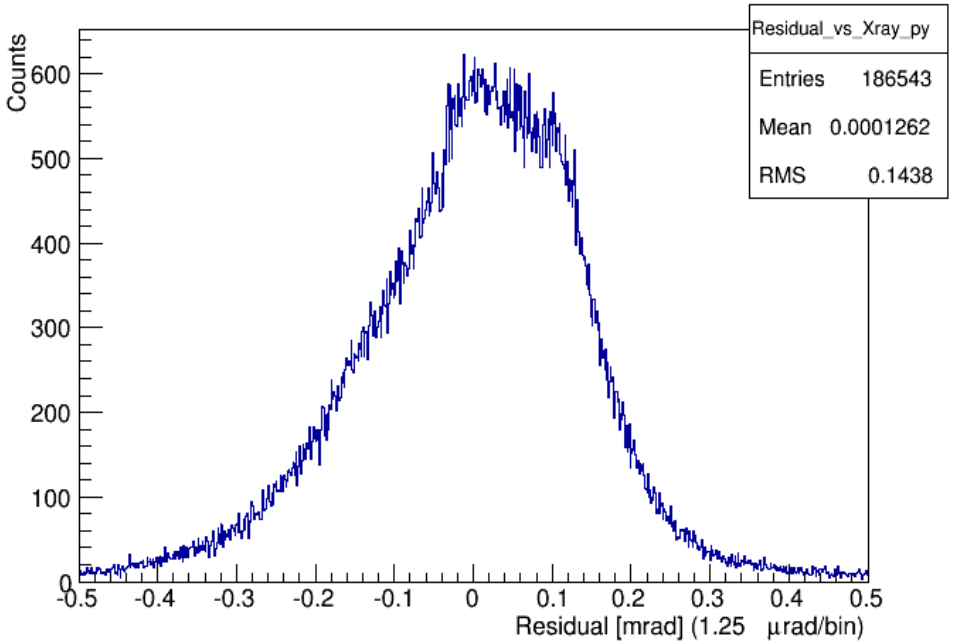


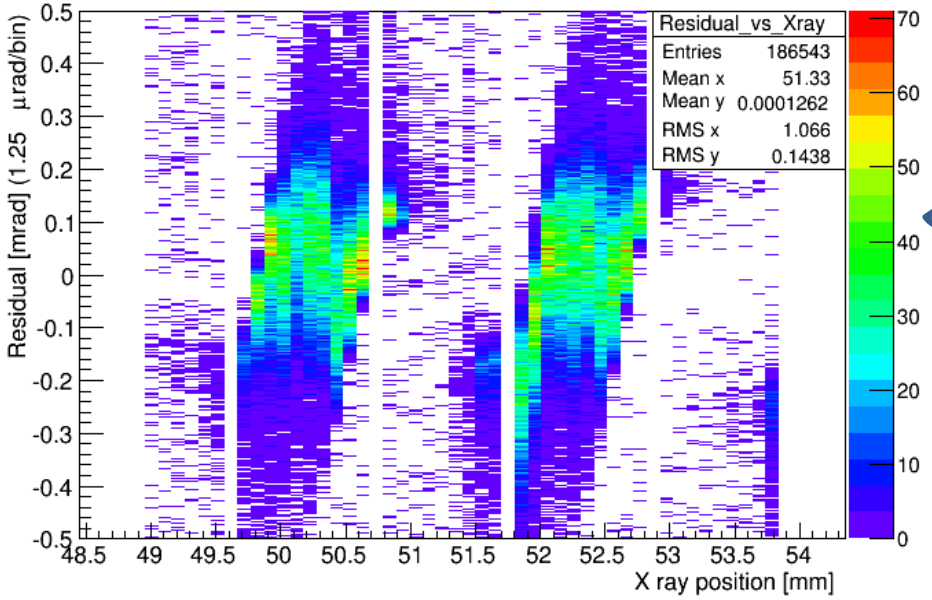


Results – scan on ZZ_48 board, along phi (across strips)

Mean Centroid (in phi) vs. X (Y=53.2 mm)



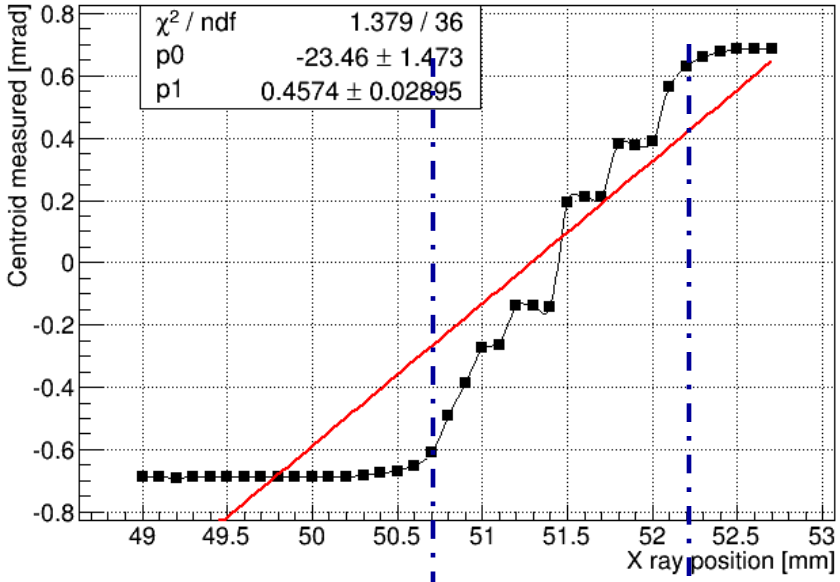


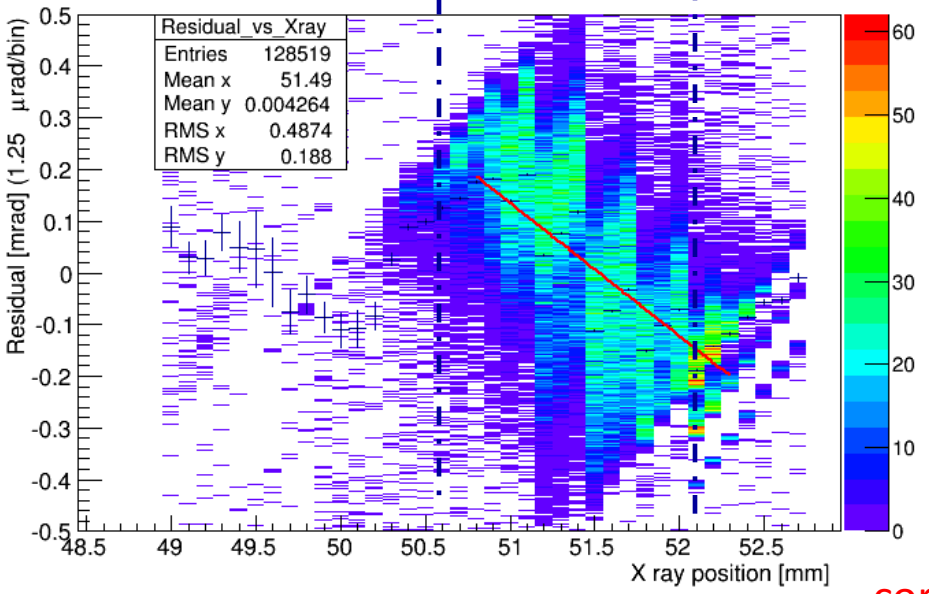


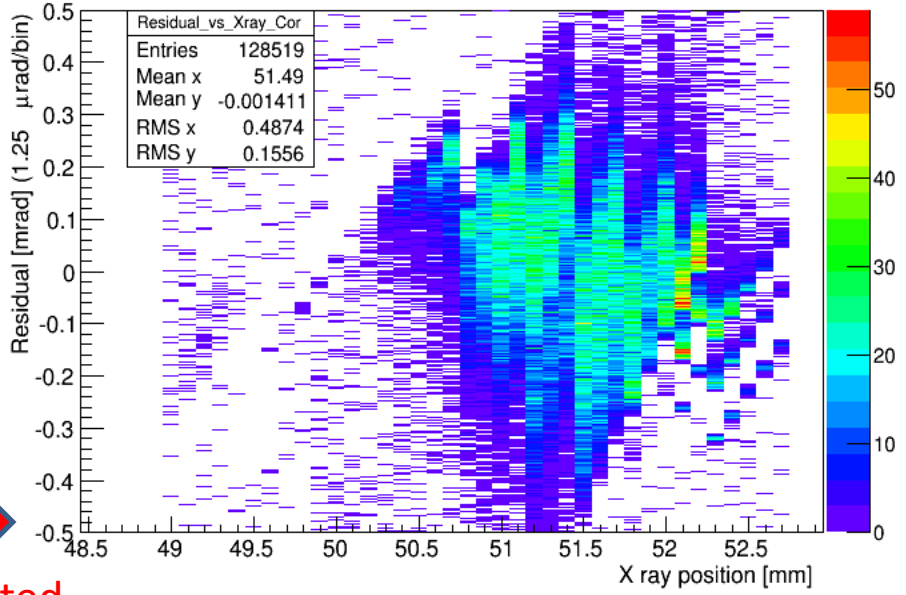
Projection in Y axis

Results – scan on ZZ_30 board, along phi (across strips)

Mean Centroid (in phi) vs. X (Y=53.2 mm)

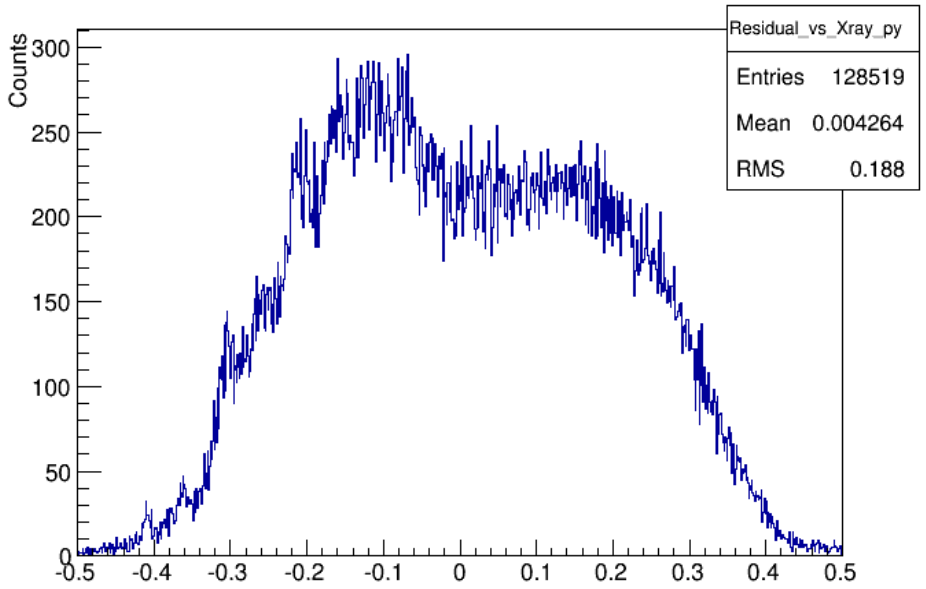


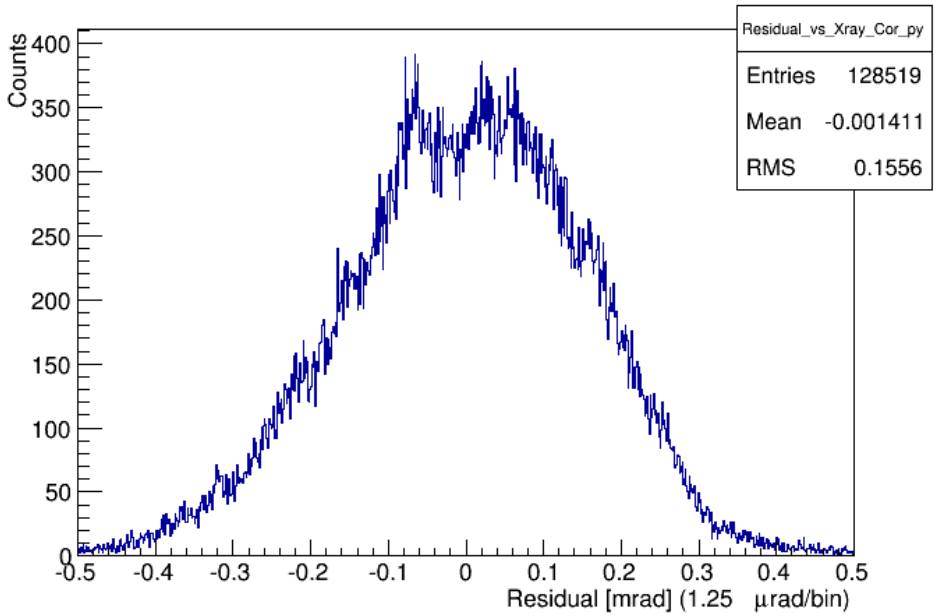


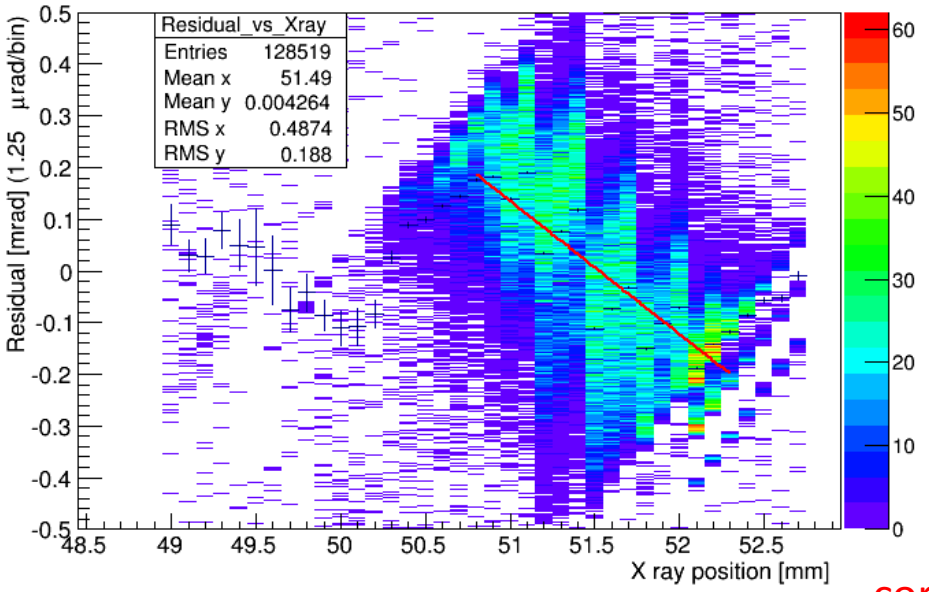


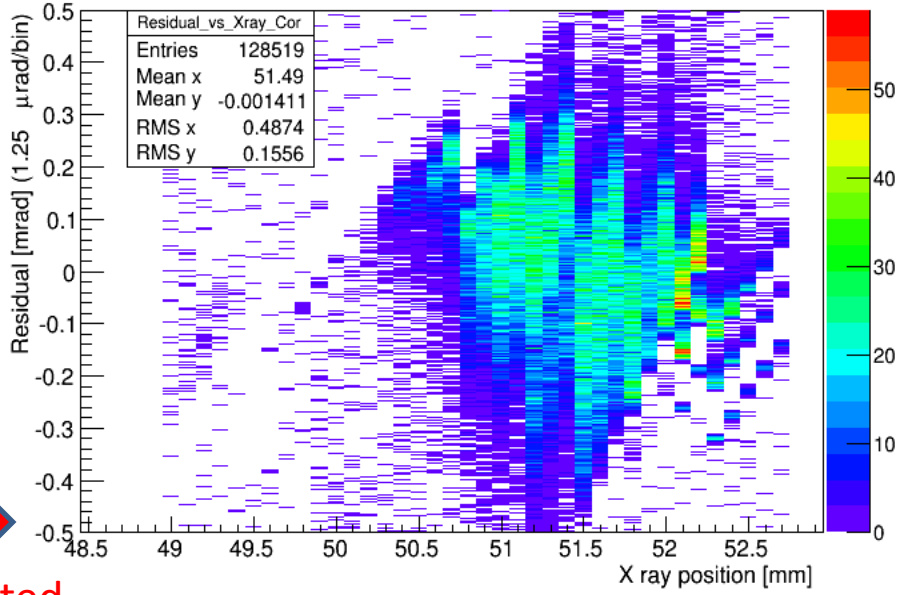
corrected

Results – scan on ZZ_30 board, along phi (across strips)

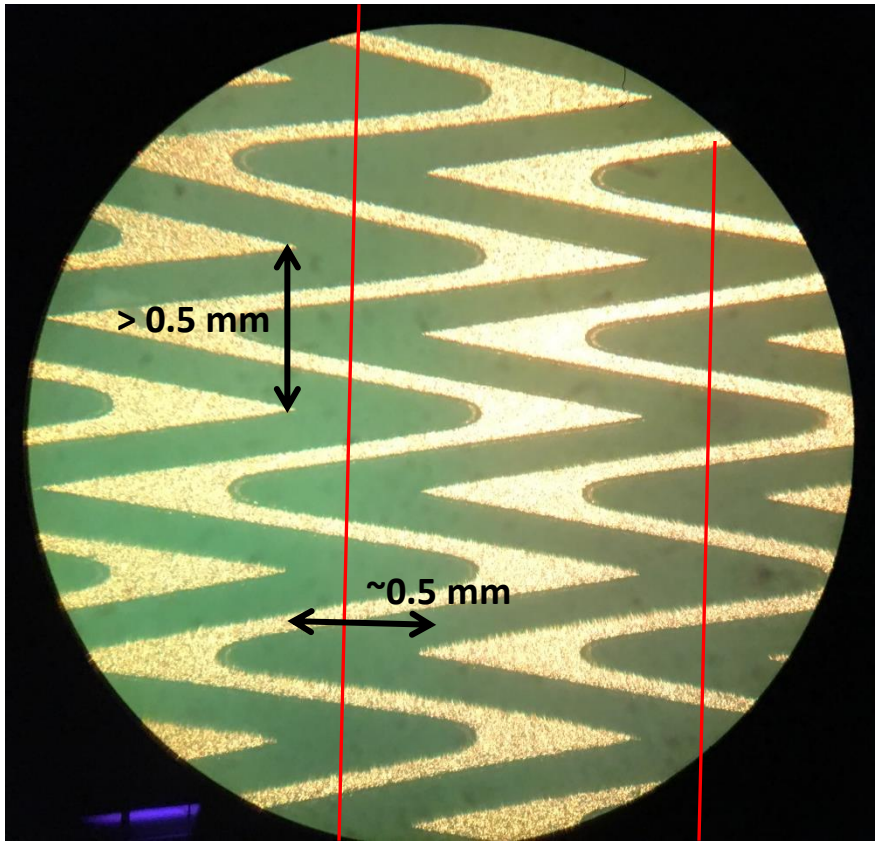






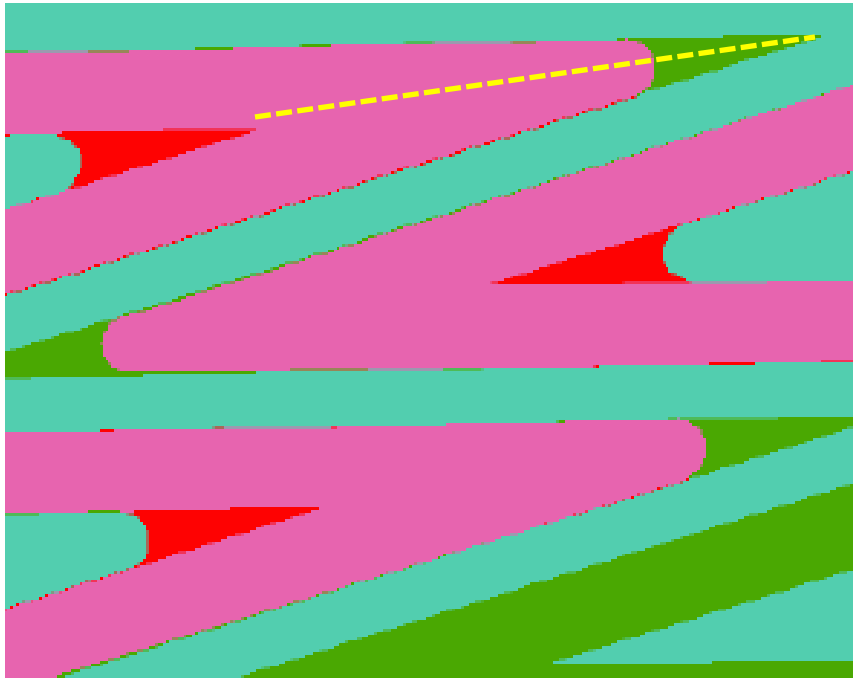


corrected

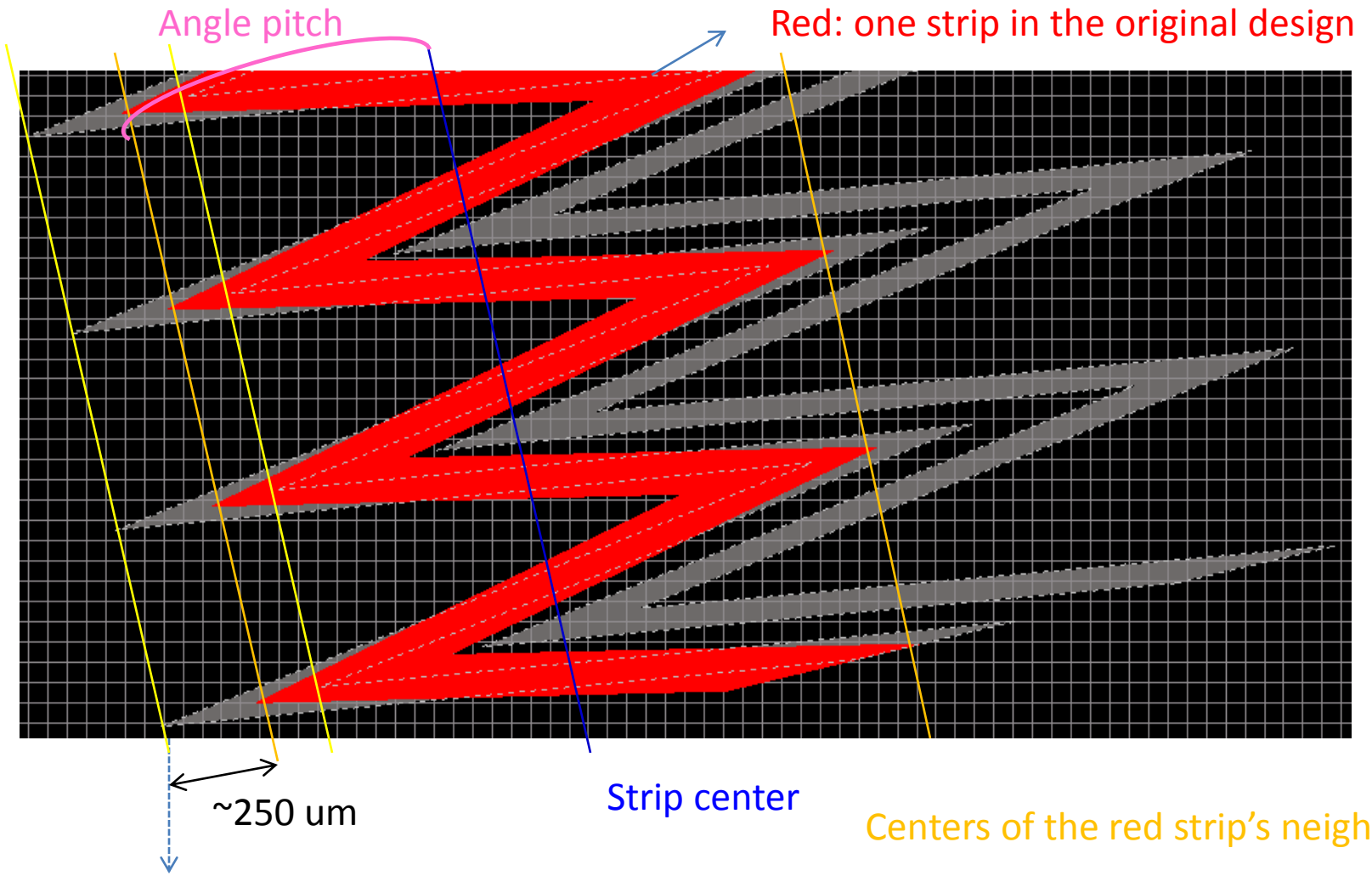


The “over-etched” length (for one strip) is about 0.3 mm, this needs to be compensated in the design.

[vertical tip distance should be 0.5 mm, and is slightly larger than 0.5 mm by measuring]
[the ~0.5 mm is measured with a caliper under a magnifier]



Green: the original design
Pink and red: tips get rounded (with radius 1.5-2 mils, or 38-50 um).
Per ACE engineer’s experiences, the tips were rounded by 1:1 (outer radius) or 1.5:1 (inner radius) [ratio is over the thickness of the feature (copper) based on 2 oz or 36 um]



Grid 50 um

Gray color region:

To compensate the "over-etching" problem, the proposed structure should interleave more into neighbor strips.

(in this design, it interleaves **30% more** of the pitch angle at outer tips, corresponds to ~250 um; the inner tips interleave **80% of** the pitch angle, to maintain reasonable line width and gap: ~50 um.)